

ITEM 236

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FULL DEPTH RECLAMATION

This Item shall govern for the furnishing, mixing, shaping, and compacting of engineered emulsion and water with the existing base and asphalt concrete pavement in the roadway. It shall include all materials, equipment, labor, tools, and other incidentals as may be required to complete the work.

1. MATERIALS:

Furnish uncontaminated materials of uniform quality that meet the requirements of the plans and specifications. Notify the Engineer of the proposed material sources and of changes to material sources. The Engineer will verify that the specification requirements are met before the sources can be used. The Engineer may sample and test project materials at any time before compaction. Use Tex-100-E for material definitions.

1.1. Emulsion. An Engineered emulsion shall be used in this project. The properties of the engineered emulsion to be used shall be determined by a mix design meeting the requirements outlined in Table 1. The engineered emulsion shall meet the minimum material requirements outlined in Table 2.

Table 1

Sampling pits shall be approximately 3'X3'X18" or as required to obtain adequate material for mix design	
Property	Criteria
Superpave gyratory compaction, 1.25° angle, 87 psi, gyrations	30
Indirect tensile strength (ITS), ASTM D 4867 Part 8.11.1, 77°F, psi, 72 hour cure	50 min.
Conditioned ITS, ASTM D 4867 (see Note 1), psi	18 min.
Resilient Modulus, ASTM D 4123, 68°F, psi	300,000 min.

1.2. Aggregate. The amount and type of added aggregate ("add rock"), if any, shall meet the requirements of Item 200, "Flexible Base", and will be determined by the mix design in order to meet the requirements in Table 1.

1.3. Reclaimed Material. A mix design is required before the start of the project. The reclaimed material at the recommended emulsion content shall meet the properties in Table 1. Based on roadway variability, more than one design may be required. The properties and quantity of asphalt emulsion, add rock, and water shall be determined by the mix design. The Contractor shall submit the mix design to the Engineer for approval prior to the start of the project. Roadway material samples shall be taken an average of 800 feet, with not less than two samples per project. Any cost associated with taking samples from the existing base, traffic control during sampling procedures, equipment used for sampling, patching the existing pavement, and providing the mix design shall be included with the unit prices for item 236 "Full Depth Reclamation".

1.4. Water. Furnish water free of industrial waste and other objectionable material.

Table 2

Test		Min.	Max
Residue from distillation, %	ASTM D244 ¹	63	
Oil distillate by distillation, %	ASTM D244 ¹		0.5
Sieve Test, %	ASTM D244 ¹		0.1
Penetration (TBD ²), 77°F, dmm	ASTM D5	-25%	+25%

¹ Modified ASTM D244 procedure – distillation temperature of 350°F with a 20 minute hold. The ASTM D244 vacuum distillation procedure may be substituted once the maximum oil distillate is satisfied.

² TBD – To be determined from the mix design prior to emulsion manufacture for project. Penetration range will be reported on the submitted mix design.

2. EQUIPMENT:

Provide machinery, tools, and equipment necessary for proper execution of the work meeting the following minimum requirements.

2.1. Reclaiming. A self-propelled reclaimer capable of fully reclaiming the existing road to the depth required. Incorporate the asphalt emulsion and water, and mix the materials to produce a homogeneous material. The minimum power of the reclaimer is 400 hp. The machine shall be capable of reclaiming no less than 8 feet wide and up to 12 inches deep in each pass. The reclaimer shall have a system for adding asphalt emulsion with a full width spray bar consisting of a positive displacement pump interlocked to the machine speed so that the amount of emulsion being added is automatically adjusted with changes in machine speed. The emulsion injection system shall be capable of incorporating up to 7 gallons per square yard of emulsion. Individual valves on the spray bar shall be capable of being turned off as necessary to minimize emulsion overlap on subsequent passes.

2.2. Shaping. A motor grader for pre-shaping, aerating, spreading, and final shaping of the material is necessary. The motor grader shall have a cross slope indicator.

2.3. Compaction. A vibratory padfoot roller with 84-inch wide drum and 10-ton minimum weight is required; a blade is recommended for back dragging. A pneumatic tire roller with 20-ton minimum weight, 90-psi tire pressure, and equipped with water spray system is required. A double drum vibratory steel roller with 10-ton minimum weight with water spray system is required.

3. CONSTRUCTION:

Work shall not proceed in the rain. The weather forecast shall not call for freezing temperatures

for seven days after incorporation of the engineered emulsion. The historical weather database shall not call for freezing temperatures within 7 days after completion of the engineered emulsion portion of the project; this shall be based on 50 percent reliability. Any deviation from these requirements requires the written authorization of the Engineer.

3.1. Pre-Shaping. The road shall be shaped by the reclaimer and/or motor grader to correct for profile, crown, and contour, according to the plans, before the addition of emulsion. Water and add rock can be added during this operation. The material shall then be compacted to support equipment and/or traffic and to provide depth control during reclaiming; compaction with a steel roller should be sufficient unless otherwise determined by the Engineer.

3.2. Reclaiming. Moisture content before emulsion addition shall be within 1 percent from the mix design recommendation and as measured in "Quality Control", Section 4.3; aerate if too wet and add water if too dry. The amount of asphalt emulsion used shall be as recommended from the mix design. The required depth of reclamation shall be monitored regularly. Prior to spreading and compacting, the material shall have a gradation meeting the requirements of "Quality Control", Section 4.2.

The entire operation shall be completed in multiple passes. The existing road shall be reclaimed to the depth of the plans, and during the first reclaimer pass, water and add rock shall be added; pre-shaping can also be accomplished at this time. After completion of the first pass, the road shall be shaped with a motor grader and compacted with a steel roller to provide better depth control. A second pass of a reclaimer shall be completed with the required amount of asphalt emulsion added. Each adjacent pass of the reclaimer shall overlap the previous pass by a minimum of six inches. If an additional pass of the reclaimer significantly improves dispersion of the emulsion, then this additional pass shall be required for the entire project.

The entire operation of reclaiming the existing road, incorporating add rock, water, and asphalt

emulsion can be completed in one pass if, in the opinion of the Engineer, adequate mixing and emulsion dispersion is achieved.

3.3. Compaction. Compact the mixture in one lift using density control unless otherwise shown on the plans. Begin rolling longitudinally at the sides and proceed towards the center, overlapping on successive trips by at least one-half the width of the roller unit. On superelevated curves, begin rolling at the low side and progress toward the high side. Offset alternate trips of the roller. Operate rollers at a speed between 2 and 6 MPH, as directed. Remove areas that loose required stability, compaction, or finish. Replace with emulsion-treated mixture at the Contractor's expense.

3.3.1. Ordinary Compaction. Roll with approved compaction equipment, as directed. Correct irregularities, depressions, and weak spots immediately by scarifying the areas affected, adding or removing treated material as required, reshaping, and recompacting.

3.3.2. Density Control. Compact to at least 97% of the maximum density determined in the mix design. The Engineer will determine roadway density in accordance with Test Method Tex-115-E. Remove material that does not meet density requirements. Remove areas that loose required stability, compaction, or finish. Replace with emulsion treated mixture and compact and test in accordance with density control methods. The Engineer may accept the section if no more than 1 of the 5 most recent density tests is below the specified density and the failing test is no more than 3% below the specified density.

3.3.3. Initial Compaction. The breakdown roller (padfoot) shall be within 500 feet of the reclaimer at all times. The padfoot roller, applying high amplitude and low frequency, shall perform initial compaction at enough passes until it walks out of the material. Walking out of the padfoot roller is defined as light being clearly evident between all the pads at the material padfoot drum interface.

3.3.4. Shaping. After the completion of padfoot rolling, any remaining padfoot marks shall be removed and the material spread using a motor grader, which shall not cut deeper than the depth of the padfoot marks. Desired slope and shaped shall be achieved to the lines and grades shown in the plans. Final surface shaping shall be performed in the same day the emulsion is incorporated into the roadway. Note: compaction will be aided if the steel roller (high frequency / low amplitude) and/or pneumatic roller follow the motor grader.

3.3.5. Intermediate and Final Compaction. The vibratory double drum steel roller and pneumatic roller shall compact the bladed material. The best combination of number of passes and order of rollers shall be used to meet compaction requirements. Do not finish roll in vibratory mode. A light spray of water may aid in final compaction density and appearance.

3.4. Curing. Before placing any surfacing, the reclaimed base shall be allowed to cure until the moisture content in the material is reduced to 2.5 percent or less, or to a moisture content acceptable to the Engineer. The reclaimed base shall be surfaced before winter.

Proof roll the compacted material with a fully loaded tandem axle truck or other means acceptable to the Engineer. It is recommended that proof rolling represent the type of traffic expected on the road. If deformation does not occur, moving truck traffic can be allowed on the reclaimed base. If deformation does occur, truck traffic should be kept off until the reclaimed material is firm enough to accommodate truck traffic without permanent deformation to the surface. It is expected that the reclaimed base can support moving car traffic after finish rolling has occurred.

4. QUALITY CONTROL:

The Contractor shall be responsible for quality control (QC) of the process and the completed reclaimed base. The sampling frequency shall be in accordance with the Engineer's requirements. Quality control shall include the following activities:

4.1. Asphalt Emulsion. A representative from the asphalt emulsion supplier will check the mixing and setting properties at the beginning of the project, and will make adjustments to the asphalt emulsion formulation if necessary.

4.2. Maximum Material Size. Prior to introduction of the emulsion, samples of the reclaimed material shall be obtained and sieved to determine compliance with the following maximum particle size requirements:

Sieve Size	Percent Passing
2.0 inch	100
1.75 inch	97 - 100

Sample size shall be 40 pounds. Sampling frequency shall be at the Engineer's discretion.

4.3. Moisture Content. Prior to emulsion addition, moisture content shall be checked by microwave oven according to ASTM D 4643 or equivalent procedure. Other suitable methods are acceptable, such as nuclear gauge, direct heating, or infrared. Minimum sample size recommended is 700 grams for the microwave procedure after screening through a $\frac{3}{4}$ inch sieve. Check the moisture content on the same day that emulsion will be added. If rain has occurred after testing and before emulsion addition, re-check the moisture content. If the average moisture content is not within 1 percent of the mix design recommendation, then it shall be adjusted by moisture addition (water truck) or by aeration. If the moisture content has been manipulated, it shall be re-checked.

The sample shall be to the depth of reclamation by a suitable method, making sure the sides of the sample hole are perpendicular to the road surface. Keep samples sealed in an airtight container until they are ready for testing.

4.4. Emulsion Content. The amount of asphalt emulsion used shall be as recommended from the mix design. The Engineer must approve any changes in asphalt emulsion content or supplier. The percentage of emulsion added shall be checked by determining the amount used by meter readings or truck weight tickets and by

estimating the quantity of road reclaimed – depth, width, length, and estimated in-place density by Proctor density (mix design or field check) or nuclear density. On the first day of processing, emulsion content shall be determined at a minimum on the first emulsion transport. Adjustments in equipment calibration shall be made if necessary. If adjustments are made, emulsion content shall be checked again. Thereafter, emulsion content shall be determined at a sampling frequency at the Engineer's discretion but not less than once per day.

4.5. Modified Proctor Density. A nuclear gauge shall be used for acceptance testing when Modified Proctor (ASTM D1557) is used as the reference density. Samples shall be obtained to the full depth of reclamation before rolling and stored in a sealed container for no longer than one hour before Proctor compaction. Material shall be compacted to a minimum of 97 percent of the Modified Proctor average reference density.

5. MEASUREMENT:

5.1. Emulsion. Emulsion will be measured by the gallon.

5.2. Emulsion Treatment. Emulsion Treatment will be measured by the square yard of surface area. The dimensions for determining the surface area is established by the widths shown on the plans and lengths measured at placement.

6. PAYMENT:

The work performed and materials furnished in accordance with this item and measured as provided under "Measurement" will be paid in accordance with Section 5.1, "Emulsion", and Section 5.2, "Emulsion Treatment." Furnishing and delivering new base will be paid in accordance with item 200, "Flexible Base (Roadway Delivery)." Mixing, spreading, blading, shaping, compacting, and finishing new or existing base material will be paid for under Section 5.2, "Emulsion Treatment."

6.1. Emulsion. Emulsion will be paid for at the unit price bid for "Emulsion." This price is full

compensation for materials, delivery, equipment, labor, tools, and incidentals.

6.2. Emulsion Treatment. Emulsion treatment will be paid for at the unit price bid for "Emulsion Treatment" for the depth specified. No additional payment will be made for thickness or width exceeding that shown on the plans. The price is full compensation for shaping existing material, loosening, mixing, pulverizing, providing emulsion, spreading, applying emulsion, compacting, finishing, curing, curing materials, blading, shaping,

maintaining shape, replacing mixture, disposing of loosened materials, processing, hauling, preparing secondary Subgrade, water, equipment, labor, tools, and incidentals.

BID ITEM:

Item 236.1: Emulsion per gallon.

Item 236.2: Emulsion Treatment for Base
(inches compacted depth) per
square yard.